Marietta City Schools

District Unit Planner

Everything on the unit planner must be included on the unit curriculum approval statement.

Accelerated Physical Science

Unit title	*Electricity and Magnetism*	**MYP year**	*3*	**Unit duration (hrs)**	*12 Hours*

Mastering Content and Skills through INQUIRY (Establishing the purpose of the Unit): ***What will students learn?***

GSE Standards

Standards

SPS10. Obtain, evaluate, and communicate information to explain the properties of and relationships between electricity and magnetism.
a. Use mathematical and computational thinking to support a claim regarding relationships among voltage, current, and resistance.
b. Develop and use models to illustrate and explain the conventional flow (direct and alternating) of current and the flow of electrons in simple series and parallel circuits. (*Clarification statement: Advantages and disadvantages of series and parallel circuits should be addressed.*)
c. Plan and carry out investigations to determine the relationship between magnetism and the movement of electrical charge. (Clarification statement: Investigations could include electromagnets, simple motors, and generators).

MCS Gifted Standards:

- **MCS.Gifted.S5B.** Recognize and build upon strengths and limitations.
- **MCS.Gifted.S5C.** Develop and practice critical analysis in judgment of one's actions, feelings and thoughts.
- **MCS.Gifted.S6C.** Persevere in the face of obstacles.
- **MCS.Gifted.S6D.** Take initiative to pursue opportunities to share and use abilities.

Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)
Students taking this course as 8th graders have not been exposed to the 8th grade Physical Science GSE.

S5P2. Obtain, evaluate, and communicate information to investigate electricity.
b. Design a complete, simple electric circuit, and explain all necessary components.
c. Plan and carry out investigations on common materials to determine if they are insulators or conductors of electricity.

S5P3. Obtain, evaluate, and communicate information about magnetism and its relationship to electricity.
a. Construct an argument based on experimental evidence to communicate the differences in function and purpose of an electromagnet and a magnet (*Clarification statement: Function is limited to understanding temporary and permanent magnets.)*

b. Plan and carry out an investigation to observe the interaction between a magnetic field and a magnetic object. *(Clarification statement: The interaction should include placing materials of various types (wood, paper, glass, metal, and rocks) and thickness between the magnet and the magnetic object.)*

Teacher Background Info:

https://www.physicsclassroom.com/class/circuits

- An electric current requires a complete circuit and a voltage source.
- The amount of current that flows in a circuit depends on both the resistance of the circuit and the voltage of the source.
- In a series circuit, the same amount of current flows through all the components.
- In a parallel circuit, the voltage drop across each branch of the circuit is equal and is also equal to the voltage of the power source.
- In a direct current circuit, the electrons flow in only one direction.
- In an alternating current, the motion of the electrons alternates back and forth, due to the changing polarity of the voltage source.
- Changes in motion generate magnetic fields.
- Variable magnetic fields induce currents in a circuit.
- A moving electrical charge, or current, in a magnetic field experiences a force.

Key Formulas and Constants:

V = IR (Ohm's Law)

I = V/R

R = V/I

Concepts/Skills to be Mastered by Students

- Electricity and Magnetism
- Energy Transformations

Key Vocabulary: (KNOWLEDGE & SKILLS)
Electricity, magnetism, electric force, magnetic force, electric field, magnetic field, electron, closed circuit, current, ampere (amp), resistance, ohm, Ohm's Law, voltage (volts), voltage drop, electrical potential energy, series circuit, parallel circuit, alternating current, direct current, conventional current, electromagnet, motor, generator, electromagnetic induction, attractive force, repulsive force

Year-Long Anchoring Phenomena: (LEARNING PROCESS)
How does matter and energy interact within the universe?

Unit Phenomena (LEARNING PROCESS)
How can we use our understanding of circuits, electrical current, and magnetism to develop an appropriate device for a given function?

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)

- Students may believe that an electrochemical cell (battery) is the source of charge in an electric circuit.
- Students may use the terms current, energy, and potential difference interchangeably with one another, when they are, in fact, different concepts.
- Students may believe that circuit components consume current.
- Students may believe that current comes out of both poles of the battery and meets at a light bulb, causing it to light.
- Students may believe that current is divided equally amongst each branch of a parallel circuit.
- Students may believe that a change before a bulb in a series circuit will affect the bulb's brightness, but the same bulb will not be affected by a change in the circuit after the bulb.
- Students may believe that batteries are constant sources of current.
- Students may have difficulty rearranging the formula V = IR, in order to solve for current or resistance.

Reference: Secondary School Students' Misconceptions about Simple Electric Circuits

https://files.eric.ed.gov/fulltext/ED564331.pdf

Key concept	Related concept(s)	Global context
Systems and System Models Systems are sets of interacting or interdependent components. Systems provide structure and order in human, natural, and built environments. Systems can be static or dynamic, simple or complex.	Movement (MYP/CCC)	**Scientific and Technical Innovation** Students will explore the natural world and its laws; the interaction between people and the natural world; how humans use their understanding of scientific principles; the impact of scientific and technological advances on communities and environments; the impact of environments on human activity; how humans adapt environments to their needs.

Statement of inquiry

Advances in science and technology have allowed humans to design systems that make use of the movement of electrons and harness the relationship between electricity and magnetism.

Inquiry questions

Factual

What is electric potential?
What are the requirements of an electric circuit?
What is the difference between direct current and alternating current?
What is the difference between series and parallel circuits? Pros and cons of each?
What are current, voltage, and resistance and what are the relationships between them?

What types of systems take advantage of the relationship between electricity and magnetism?

Conceptual

How can I illustrate the flow of current/electrons in series and parallel circuits?
How can I use certain components to design a complete circuit and explain the flow of electrons?
How can I use a circuit diagram to predict the flow of current through a circuit?
How can I use Ohm's Law to determine current, voltage, and resistance in a given circuit?
How do I demonstrate the relationship between magnetism and electrical charge?

Debatable

What is the best design for an electromagnet that needs to lift a certain amount of material?
What are some potential applications of electromagnets that have yet to be discovered?

MYP Objectives	**Assessment Tasks**	
*What specific MYP **objectives** will be addressed during this unit?*	***Relationship** between summative assessment task(s) and statement of inquiry:*	*List of common formative and summative assessments.*
Science A: Knowing and Understanding I. describe scientific knowledge Ii. apply scientific knowledge and understanding to solve problems set in familiar and unfamiliar situations Science B: Inquiring and Designing I. describe a problem or question to be tested by a scientific investigation Iv. design scientific investigations Science C: Processing and Evaluating	SOI: Advances in science and technology have allowed humans to design systems that make use of the movement of electrons and harness the relationship between electricity and magnetism. Humans consistently rely upon electricity, magnetism, and the relationship between them in their everyday lives. In this unit, students will be tasked with building various circuits in order to demonstrate the movement of charge and relate small scale circuitry to the systems we rely upon to power our homes. Given appropriate materials, or through the use of simulations, students are tasked with designing circuits, explaining the necessary components of circuits, articulating their conceptual understanding of the movement of electrical charge in simple series and parallel circuits, as well as using Ohm's Law to calculate current, voltage, and resistance. The unit assessment will require students to determine and/or predict what will occur, given various circuitry scenarios, while also calculating current, voltage, and resistance. Students will apply their understanding of simple circuitry to discuss and describe the use and applications of electricity and magnetism in their everyday lives. The assessment will measure students' ability to evaluate the overall characteristics of a circuit, determine its properties, and make a claim as to its usability and usefulness.	**Formative Assessment(s):** SPS10a.b. CFA **Summative Assessment(s):** Electricity & Magnetism Unit Assessment Paper I and Paper II

I. present collected and transformed data Ii. interpret data and describe results using scientific reasoning Science D: Reflecting on the Impacts of Science I. describe the ways in which science is applied and used to address a specific problem or issue Iii. apply scientific language effectively Design B: Developing Ideas Iii. present the chosen design and outline the reasons for its selection Iv. develop accurate planning drawings/diagrams and outline requirements for the creation of the chosen solution Design C: Creating the Solution Iii. follow the plan to create the solution, which functions as intended Design D: Evaluating Ii. explain the success of the solution against the design specification Iii. describe how the solution could be improved		
Approaches to learning (ATL)		
Category: Social		

Cluster: Collaboration Skills
Skill Indicator: Work effectively with others.

Learning Experiences Add additional rows below as needed.		
Objective or Content	**Learning Experiences**	**Personalized Learning and Differentiation**
SPS10. Obtain, evaluate, and communicate information to explain the properties of and relationships between electricity and magnetism. a. Use mathematical and computational thinking to support a claim regarding relationships among voltage, current, and resistance.	Exploration of Circuits and Ohm's Law PhET Sim	• Discovery Education High School Physics Science Techbook • NGSS Case Studies for Differentiated Learners • Next Generation Science Standards: "All Standards, All Students" • Extensions – Enrichment Tasks/Projects All information included by PLC in the differentiation box is the responsibility and ownership of the local school to review and approve per Board Policy IKB. Task-Specific Differentiation • Scaffolding of Practice • Visual Modeling • Small Group • Multiple Means of Engagement • Multiple Means of Content Representation (laboratories, SIM, DE Techbook) • Multiple Means of Action and Expression • Design Choices
SPS10. Obtain, evaluate, and communicate information to explain the properties of and relationships between electricity and magnetism. b. Develop and use models to illustrate and explain the conventional flow (direct and alternating) of current and the flow of electrons in simple series and parallel circuits. (*Clarification statement: Advantages and disadvantages of series and parallel circuits should be addressed.*)	Exploration of Circuits and Ohm's Law PhET Sim	
SPS10. Obtain, evaluate, and communicate information to explain the properties of and relationships between electricity and magnetism. c. Plan and carry out investigations to determine the relationship between magnetism and the movement of electrical charge. (Clarification statement: Investigations could include electromagnets, simple motors, and generators).	Electricity and Magnetism Lab (Explore Motors & Generators + Design an Electromagnet)	

Content Resources		
Discovery Education Physics Science Techbook Unit 1: Forces -Concept 1.4: Electric Forces Unit 4: Electromagnetism -Concept 4.1: Electric and Magnetic Fields -Concept 4.2: Electricity and Magnetism -Concept 4.3: Electric Circuits Physics Classroom: Electric Circuits GaDOE Instructional Segment: -Energy Part Three: Limit the Resistance to Learn About Electricity		